WHAT IS CLAIMED IS:

1. A voltage regulator for generating an output voltage from an input voltage, comprising:

at least one coupled inductor including a first winding and a second winding each having a polarity, the first winding and the second winding connected in series to form a common node and such that the first winding and the second winding have the same polarity, the first winding and the second winding having a coefficient of coupling approximately equal to one;

a conduction switch having an on-state and an off-state, to controllably conduct the input voltage to the at least one coupled inductor at a switching frequency; and

a freewheeling switch having an on-state and an off-state, in communication with the common node of the at least one coupled inductor to provide a path for current when the conduction switch is in the off-state.

2. The voltage regulator of Claim 1 wherein the coefficient of coupling is at least 0.99.

3. The voltage regulator of Claim 1 wherein the first winding has a number of turns N1, and the second winding has a number of turns N2;

a turns ratio is defined as N1/N2 and set to a predetermined value of at least two.

4. The voltage regulator of Claim 3 wherein the turns ratio is approximately two.

5. The voltage regulator of Claim 1 wherein the coupled inductor is formed on a single core of magnetic material.

6. The voltage regulator of Claim 1 further comprising an output capacitor in communication with the at least one coupled inductor to filter the output voltage.

7. The voltage regulator of Claim 1 wherein the conduction switch includes parallel independently controlled switches.

8. The voltage regulator of Claim 1 further comprising a multi-level gate drive to control the conduction switch.

9. The voltage regulator of Claim 1 wherein the freewheeling switch is selected from a group consisting of uni-directional switches, bi-directional switches, diodes, rectifiers, synchronous rectifiers, FETs, NMOS, PMOS, BJTs, and IGBTs.

10. The voltage regulator of Claim 1 further comprising at least another voltage regulator connected in parallel with the voltage regulator.

11. A voltage regulator for generating an output voltage from an input voltage, comprising:

at least one coupled inductor including a first winding and a second winding each having a polarity, the first winding and the second winding connected in series to form a common node and such that the first winding and the second winding have the same polarity, the first winding and the second winding having a coefficient of coupling approximately equal to one;

means for conduction switching having an on-state and an off-state, to controllably conduct the input voltage to the at least one coupled inductor at a switching frequency; and

means for freewheeling switching having an on-state and an off-state, in communication with the common node of the at

least one coupled inductor to provide a path for current when the conduction switching means is in the off-state.

12. The voltage regulator of Claim 11 wherein the coefficient of coupling is at least 0.99.

13. The voltage regulator of Claim 11 wherein the first winding has a number of turns N1, and the second winding has a number of turns N2;

a turns ratio is defined as N1/N2 and set to a predetermined value of at least two.

14. The voltage regulator of Claim 13 wherein the turns ratio is approximately two.

15. The voltage regulator of Claim 11 wherein the coupled inductor is formed on a single core of magnetic material.

16. The voltage regulator of Claim 11 further comprising means for filtering in communication with the at least one coupled inductor to filter the output voltage.

17. The voltage regulator of Claim 11 wherein the conduction switching means includes parallel independently controlled switches.

18. The voltage regulator of Claim 11 further comprising a multi-level gate drive to control the conduction switching means.

19. The voltage regulator of Claim 11 wherein the freewheeling switching means is selected from a group consisting of uni-directional switches, bi-directional switches, diodes, rectifiers, synchronous rectifiers, FETs, NMOS, PMOS, BJTs, and IGBTs.

20. The voltage regulator of Claim 11 further comprising at least another voltage regulator connected in parallel with the voltage regulator.

21. The voltage regulator of Claim 1 wherein the conduction switch is selected from a group consisting of Field Effect Transistors (FETs), NMOS, PMOS, Bipolar Junction Transistors (BJTs), and Integrated Gate Bipolar Junction Transistors (IGBTs).

22. The voltage regulator of Claim 10 further comprising a phase generator in communication with each of the voltage regulators to control a phase sequence of the voltage regulators.

23. The voltage regulator of Claim 11 wherein the means for conduction switching is selected from a group consisting of Field Effect Transistors (FETs), NMOS, PMOS, Bipolar Junction Transistors (BJTs), and Integrated Gate Bipolar Junction Transistors (IGBTs).

24. The voltage regulator of Claim 20 further comprising means for phase controlling in communication with each of the voltage regulators to control a phase sequence of the voltage regulators.

25. The voltage regulator of Claim 1 further comprising a controller to control the on-time of the conduction switch such that the output voltage is regulated to a predetermined amplitude.

26. The voltage regulator of Claim 1 wherein the freewheeling switch has a lower withstanding voltage than the conduction switch.

27. The voltage regulator of Claim 1 wherein the freewheeling switch and the conduction switch are Field Effect Transistors and the freewheeling switch has a lower Rds(on) than the conduction switch.

28. The voltage regulator of Claim 11 wherein the means for freewheeling switching has a lower withstanding voltage than the means for conduction switching.

29. The voltage regulator of Claim 11 wherein the means for freewheeling switching and the means for conduction switching are Field Effect Transistors and the means for freewheeling switching has a lower Rds(on) than the means for conduction switching.